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PATENT
Case No. N0080US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Joshi et al.

Serial No.: 09/729,939

Filed: December 5, 2000

For: Method and System for Representation of Geographic Features in a Computer-Based System

Group: 2164

Examiner:
Melissa M. Chojnacki

Fee Authorization

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PATENT
Case No. N0080US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	09/729,939
Applicant	:	Rajashri Joshi et al.
Filed	:	December 5, 2000
Titled	:	Method and System for Representation of Geographic Features In a Computer-based System
TC/A.U.	:	2164
Examiner	:	Mellissa M. Chojnacki
Docket No.	:	N0080US

APPEAL BRIEF

This appeal brief is submitted pursuant to 37 CFR 41.37. This is an appeal of the Office Action dated July 24, 2008. A Notice of Appeal was filed on November 24, 2008. The Office Action dated July 24, 2008 was the result of prosecution of the present application being reopened after the Appellants filed an appeal brief on April 18, 2008.

(1) REAL PARTY IN INTEREST

The real party in interest is NAVTEQ North America, LLC (formerly named Navigation Technologies Corporation), a publicly-traded corporation that has its headquarters in Chicago, Illinois.

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PAGE 3/32 * RCVD AT 12/9/2008 1:59:57 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-5/13 * DNIS:2738300 * CSID:3128947228 * DURATION (mm-ss):05-12

(2) RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

(3) STATUS OF CLAIMS

Claims 1-3, 8-14, 16-27, 29-34 and 36-37 were rejected under 35 USC 103(a) as obvious over Sennott (U.S. Pat. No. 5,438,517) in view of Bargar (U.S. Pat. No. 6,009,394). Claims 1-3, 8-14, 16-27, 29-34 and 36-37 were also rejected under 35 USC 103(a) as obvious over Sennott in view of Eberwine (U.S. Pat. No. 6,133,867).

Claims 4, 15, 28 and 35 were rejected under 35 USC 103(a) as obvious over Sennott in view of Bargar in further view of Dayanand (U.S. Pat. No. 6,639,592). Claims 4, 15, 28 and 35 were also rejected under 35 USC 103(a) as obvious over Sennott in view of Eberwine in further view of Dayanand (U.S. Pat. No. 6,639,592).

Claims 5-7 were rejected under 35 USC 103(a) as obvious over Sennott in view of Bargar in further view of Rohm (U.S. Pat. No. 6,253,164). Claims 5-7 were also rejected under 35 USC 103(a) as obvious over Sennott in view of Eberwine in further view of Rohm (U.S. Pat. No. 6,253,164).

Claims 1-37 have been appealed.

(4) STATUS OF AMENDMENTS

There has been no amendment filed subsequent to the final rejection of January 2, 2008.

(5) SUMMARY OF INVENTION

Independent Claim 1 relates to a method for representing geographic features in a computer-based system (page 3, lines 18-19; FIG. 5). The method includes providing a first database (page 4, lines 15-16; 14 in FIG. 4) that stores a plurality of data points (page 5, lines 7-8; 22 in FIG. 5). The data points specify latitude and longitude coordinates of locations along a geographic feature (page 4, lines 26-29; 15 in FIG. 4). The method also includes fitting a polynomial spline to the geographic feature to generate a plurality of control points (page 6, lines 24-26; 26 in FIG. 5) and storing the control point in a second database (page 6, lines 31-32, 16 in FIG. 4, 28 in FIG. 5). The control points are generated by applying a least squares approximation to the data points (page 6, lines 24-26). The control points may be used to represent the geometry of the geographic feature (page 16, lines 27-32).

Independent Claim 14 relates to a method of displaying on a computer output device a function representing a geographic feature (page 16, lines 21-22; FIG. 9). The method includes retrieving from a database (page 16, line 23; 54 in FIG. 8) a plurality of spline control points associated with the geographic feature (page 16, lines 28-29; 82 in FIG. 9). The spline control points being derived using a least squares approximation from a plurality of data points (page 6, lines 24-26). The data points specify latitude and longitude coordinates of locations along the geographic feature (page 4, lines 26-29; 15 in FIG. 4). The method also includes calculating a polynomial spline using the spline control points to generate the function representing the geographic feature (page 16, lines 29-30; 84 in FIG. 9) and displaying the function on the computer output device (page 16, lines 30-32; 86 in FIG. 9).

Independent Claim 16 relates to a method of generating a computer-usable database that represents feature geometry (page 3, lines 18-19; FIG. 5). The method includes providing a

predetermined database (page 4, lines 15-16; 14 in FIG. 4) that represents feature geometry using a plurality of data points (page 5, lines 7-8; 22 in FIG. 5). The data points specify latitude and longitude coordinates of locations along the geographic features (page 4, lines 26-29; 15 in FIG. 4). The method also includes retrieving a corresponding set of data points for each of the geographic features and fitting a polynomial spline to each of the geographic features by computing a plurality of control points yielding the least squares approximation to the corresponding set of data points (page 6, lines 24-26; 26 in FIG. 5). The method further includes storing the spline control point in the computer-usable database (page 6, lines 31-32, 28 in FIG. 5).

Independent Claim 23 relates to a system for displaying a function representing the geometry of a geographic feature (page 16, lines 21-22; FIG. 8). The system includes a database storing spline control points associated with the geographic feature (page 16, line 23; 54 in FIG. 8). The spline control points being derived using a least squares approximation from a plurality of data points (page 6, lines 24-26). The data points specify latitude and longitude coordinates of locations along a geographic feature (page 4, lines 26-29; 15 in FIG. 4). The system also includes a processor configured to compute a polynomial spline using the spline control points to generate the function representing the geometry of the geographic feature (page 16, lines 24-26, 29-30; 58 in FIG. 8) and a display device for displaying the polyline (page 16, lines 30-32; 56 in FIG. 8).

Independent Claim 29 relates to a system for generating a plurality of spline control points that represent feature geometry (page 4, lines 12-14; FIG. 4). The system includes a first database (page 4, lines 15-16; 14 in FIG. 4) that stores a plurality of data points (page 4, lines 15-16; 14 in FIG. 4). The data points specify latitude and longitude coordinates of locations along a

geographic feature (page 4, lines 26-29; 15 in FIG. 5). The system also includes a processor configured to apply a least squares approximation to the data points to generate the plurality of control points for a polynomial spline (page 5, lines 18-20; page 6, lines 24-26; 12 in FIG. 4). The system further includes a second database for storing the control point (page 6, lines 31-32, 16 in FIG. 4).

Dependent Claim 2 recites that the data points described in independent base Claim 1 are selected from the group consisting of coordinate pairs and coordinate triples (page 4, lines 27-28). Dependent Claim 3 recites that the method described in independent base Claim 1 further includes configuring the number of control points (page 6, lines 10-12, 24 in FIG. 5).

Dependent Claim 4 recites that the polynomial spline described in independent base Claim 1 is selected from the group consisting of uniform nonrational B-spline, non-uniform nonrational B-spline, uniform Catmull-Rom spline, nonuniform Catmull-Rom spline, and NURBS (page 6, lines 20-22). Dependent Claim 15 recites that the polynomial spline described in independent base Claim 14, dependent Claim 28 recites that the polynomial spline described in independent base Claim 23, and dependent Claim 35 recites that the polynomial spline described in independent base Claim 29 are also selected from the above listed group consisting of uniform nonrational B-spline, non-uniform nonrational B-spline, uniform Catmull-Rom spline, nonuniform Catmull-Rom spline, and NURBS (page 6, lines 20-22).

Dependent Claim 5 recites that the method described in independent base Claim 1 further includes defining a knot sequence for the polynomial spline (page 7, lines 28-30). Dependent Claim 6 recites that the method described in dependent base Claim 5 further includes manually defining the knot sequence (page 7, lines 28-30). Dependent Claim 7 recites that the method

described in dependent base Claim 5 further includes storing the knot sequence in the second database (16 in FIG. 4).

Dependent Claim 8 recites that the method described in independent base Claim 1 further includes incorporating in the least squares approximation a bearing value associated with a node included in the plurality of data points (page 8, lines 22-25). Dependent Claim 9 recites that the method described in independent base Claim 1 further includes weighting a node included in the plurality of data points in the least squares approximation (page 8, line 29 – page 9, line 3). Dependent Claim 10 recites that the method described in independent base Claim 1 further includes employing regularization in computing the least squares approximation (page 10, lines 1-14).

Dependent Claim 11 recites that the method described in independent base Claim 1 further includes identifying a straight section of the at least one geographic feature (page 15, lines 19-20, FIG. 6) and storing in the second database the data points corresponding to the straight sections (page 15, lines 22-24). Dependent Claim 12 recites that the method described in dependent base Claim 11 further includes computing control points for one or more curved sections of the at least one geographic feature (page 15, line 25, page 16, lines 10-11). Dependent Claim 13 recites that the method described in dependent base Claim 11 further includes computing control points such that the tangent to the spline approximation of a curved section of the at least one geographic feature and the tangent to the straight sections are equal at the point at which the curved and straight section meet (page 16, lines 5-8).

Dependent Claim 17 recites that the method described in independent base Claim 16 further includes identifying a straight section of a geographic feature based on the data points (page 15, lines 19-20, FIG. 6) and storing in the database the data points corresponding to the

straight section (page 15, lines 22-24). Dependent Claim 18 recites that the method described in dependent base Claim 17 further includes computing control points only for one or more curved sections of the geographic feature (page 15, line 25, page 16, lines 10-11). Dependent Claim 19 recites that the method described in dependent base Claim 17 further includes computing control points for a geographic feature that has a curved section and an adjoining straight section such that a bearing value at an endpoint of the curved section equals a corresponding bearing value at an endpoint of the straight section that meets the curved section (page 16, lines 4-11).

Dependent Claim 20 recites that the method described in independent base Claim 16 further includes incorporating in the least squares approximation a bearing value associated with a node in the plurality of data points (page 8, lines 22-25). Dependent Claim 21 recites that the method described in independent base Claim 16 further includes weighting a node included in the plurality of data points (page 8, line 29 – page 9, line 3). Dependent Claim 22 recites that the method described in independent base Claim 16 further includes employing regularization in computing the least squares approximation (page 10, lines 1-14).

Dependent Claim 24 recites that the spline control points described in independent base Claim 23 further are derived by incorporating in the least squares approximation a bearing value associated with a node in the plurality of data points (page 8, lines 22-25). Dependent Claim 25 recites that the spline control points described in independent base Claim 23 are derived using the least squares approximation by weighting a node included in the plurality of data points (page 8, line 29 – page 9, line 3). Dependent Claim 26 recites that the spline control points described in independent base Claim 23 are derived by employing regularization in computing the least squares approximation (page 10, lines 1-14). Dependent Claim 26 recites that the spline control points described in independent base Claim 23 are derived by employing regularization

in computing the least squares approximation (page 10, lines 1-14). Dependent Claim 27 recites that the processor described in independent base Claim 23 is configured to determine whether the geographic feature includes a straight section, and if so, linearly interpolate the data points representing the straight section (page 15, lines 19-22).

Dependent Claim 30 recites that the processor described in independent base Claim 29 is configured to incorporate in the least squares approximation a bearing value associated with a node in the plurality of data points (page 8, lines 22-25). Dependent Claim 31 recites that the processor described in independent base Claim 23 is configured to weight a node included in the plurality of data points in the least squares approximation (page 8, line 29 – page 9, line 3). Dependent Claim 32 recites that the processor described in independent base Claim 29 is configured to employ regularization in computing the least squares approximation (page 10, lines 1-14). Dependent Claim 33 recites that the processor described in independent base Claim 29 is configured to determine whether the geographic feature includes a straight section, and if so, to store in the second database the data points corresponding to the straight section (page 15, lines 19-24). Dependent Claim 34 recites that the processor described in independent base Claim 29 computes the control points only for one or more curved sections of the geographic feature (page 15, line 25, page 16, lines 10-11).

Dependent Claim 36 recites that the geographic feature described in independent base Claim 1 is a road (page 1, lines 13-15). Dependent Claim 37 recites that the data points described in independent base Claim 1 specify altitude (page 4, line 28).

(6) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. At issue is whether Appellants' Claims 1-3, 8-14, 16-27, 29-34 and 36-37 are obvious over Sennott (U.S. Pat. No. 5,438,517) in view of Bargar (U.S. Pat. No. 6,009,394),

B. At issue is whether Appellants' Claims 1-3, 8-14, 16-27, 29-34 and 36-37 are obvious over Sennott (U.S. Pat. No. 5,438,517) in view of Eberwine (U.S. Pat. No. 6,133,867),

C. At issue is whether Appellants' Claims 4, 15, 28 and 35 are as obvious over Sennott in view of Bargar in further view of Dayanand (U.S. Pat. No. 6,639,592),

D. At issue is whether Appellants' Claims 4, 15, 28 and 35 are as obvious over Sennott in view of Eberwine in further view of Dayanand (U.S. Pat. No. 6,639,592),

E. At issue is whether Appellants' Claims 5-7 are obvious over Sennott in view of Bargar in further view of Rohm (U.S. Pat. No. 6,253,164).

F. At issue is whether Appellants' Claims 5-7 are obvious over Sennott in view of Eberwine in further view of Rohm (U.S. Pat. No. 6,253,164).

(7) ARGUMENT

A. Claims 1-3, 8-14, 16-27, 29-34 and 36-37 are not obvious in view of the combination of Sennott and Bargar.

1. Claims 1-3, 8-13, 29-34 and 36-37 are not obvious.

Appellants' independent Claim 1 relates to a method for representing geographic features including the step of fitting a polynomial spline to the geographic feature "*by applying a least squares approximation* to the data points specifying latitude and longitude coordinates to generate a plurality of control points for the polynomial spline." Appellants' independent Claim 29 relates to a system for generating a plurality of spline control points including a processor

configured to *"apply a least squares approximation* to the data points specifying latitude and longitude coordinates to generate the control points for a polynomial spline." In the Office Action, Appellants' independent Claims 1 and 29 were rejected as being obvious in view of the combination of Sennott and Bargar.

Claims 1 and 29 are not obvious in view of the combination of Sennott and Bargar because these references fail to disclose or suggest the claim element of *applying a least squares approximation* to data points specifying latitude and longitude coordinates to generate the control points for the polynomial spline. The Office Action stated that "Sennott et al. does not teach fitting a polynomial spline to the at least one geographic feature by applying a least squares approximation," and the Office Action cited Bargar as disclosing this claim element. (See, Office Action: page 3). However, Bargar also fails to disclose the claim element.

The Bargar patent describes a system for generating a sound output based on the input movement of the music conductor's wand. (See, Bargar: Abstract, lines 10-12). Although Bargar discloses fitting a polynomial spline, Bargar discloses fitting the spline in a totally different manner than recited by the claimed invention. That is, Bargar discloses using a genetic algorithm (referred to as GA in Bargar) to generate the control points for the spline, (See, Bargar: column 5, lines 7-9; column 6, lines 1-23, 60-64), not the Applicants' recited least squares approximation to generate the control points for the polynomial spline. As known to those of ordinary skill in the art, the genetic algorithm begins with candidate solutions and evolves in generations toward better solutions. In each generation, a fitness function evaluates the solution.

The Office Action cited the sentence at column 6, lines 60-64 of Bargar as disclosing the above recited claim element, the sentence is reproduced for convenience: "This smoothing is done with a GA, where the bit vector representation of a sequence of spline segments is

preferably a vector of fixed-point control points and the fitness function approximates a least-squares error measure integrated over the original path." Simply, the Bargar discloses using the genetic algorithm to generate the control points for the spline. The fitness function of a least-squares error measure does not generate the control points to fit the spline, rather; the fitness function merely evaluates the solution for each generation of the genetic algorithm as compared to the original path. Thus, Bargar clearly discloses using the genetic algorithm to generate the control points for the spline and not the claimed least squares approximation. Therefore, Bargar (and the combination of Bargar and Sennott) do not disclose the claim element of applying a least squares approximation to generate the control points for a polynomial spline.

The claim element of *applying a least squares approximation* to data points specifying latitude and longitude coordinates to generate the control points for the polynomial spline that is missing in both Sennott and Bargar is not a familiar element in the prior art. In fact, this present appeal is the third appeal for this patent application because each office action has failed to identify prior art disclosing this claim element. Moreover, this claim element -- that is missing from the cited prior art -- provides an unexpected result for the claimed invention. That is, the least squares approximation to generate the polynomial spline control points provides an adequate fit to model the curvature of roads for use in a geographic database for a navigation system.

Both Sennott and Bargar not only fail to disclose the claim element but also fail to predict this result of the claimed invention. Both Sennott and Bargar discuss robust and very accurate fits for the splines. Sennott discloses using a robust method to fit the B-splines to the path for the autonomous mining vehicle to ensure continuity in curvature that will allow the vehicle to steer and readily follow the path. (See, Sennott: column 50, lines 58-66; column 52, lines 2-14).

Likewise, Bargar's genetic algorithm also provides a very robust fit. These robust fits of Sennott and Bargar would not be achieved by the least squares approximation.

Accordingly, for at least these reasons, independent Claims 1, 29 and dependent Claims 2-3, 8-13, 30-34 and 36-37 which depend upon Claims 1 and 29 are not obvious in view of the combination of Sennott and Bargar.

2. Claims 14 and 23-27 are not are not obvious.

Appellants' independent Claim 14 relates to a method of displaying a function representing a geographic feature where the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates. Appellants' independent Claim 23 relates to a system for displaying a function representing the geometry of a geographic feature where the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates.

In the Office Action, Appellants' independent Claims 14 and 23 were rejected as being obvious in view of the combination of Sennott and Bargar. However, Claims 14 and 23 are not obvious in view of the combination of Sennott and Bargar because these references fail to disclose or suggest the claim element of the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates. The Office Action stated that "Sennott et al. does not teach the spline control points being derived, using a least squares approximation," and the Office Action cited Bargar as disclosing this claim element. (See, Office Action: page 10). However, Bargar also fails to disclose the claim element.

As discussed above in conjunction with Claims 1 and 29, Bargar discloses determining the spline control points in a totally different manner than recited by the claimed invention. That

is, Bargar discloses using a genetic algorithm (referred to as GA in Bargar) to generate the control points for the spline, (See, Bargar: column 5, lines 7-9; column 6, lines 1-23, 60-64), not the Applicants' recited least squares approximation to derive the spline control points. Therefore, Bargar (and the combination of Bargar and Sennott) do not disclose the claim element of the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates.

The claim element of the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates that is missing in both Sennott and Bargar is not a familiar element in the prior art. Moreover, this claim element -- that is missing from the cited prior art – provides an unexpected result for the claimed invention. That is, deriving the spline control points using a least squares approximation provides an adequate fit to model the curvature of roads for use in a geographic database for a navigation system. Both Sennott and Bargar not only fail to disclose the claim element but also fail to predict this result of the claimed invention. Both Sennott and Bargar discuss robust and very accurate fits for the splines that would not be achieved by the least squares approximation.

Accordingly, for at least these reasons, independent Claims 14, 23 and dependent Claims 24-27 which depend upon Claim 23 are not obvious in view of the combination of Sennott and Bargar.

3. Claims 16-22 are not obvious.

Appellants' independent Claim 16 relates to a method of generating a computer-usable database including the step of fitting a polynomial spline by computing a plurality of control points yielding the *"least squares approximation"* of the data points specifying latitude and longitude coordinates. In the Office Action, Appellants' independent Claim 16 was rejected as

being obvious in view of the combination of Sennott and Bargar. However, Claim 16 is not obvious in view of the combination of Sennott and Bargar because these references fail to disclose or suggest the claim element of fitting a polynomial spline by computing a plurality of control points yielding the *"least squares approximation"* of the data points specifying latitude and longitude coordinates. The Office Action stated that "Sennott et al. does not teach plurality of spline control points yielding the least squares approximation," and the Office Action cited Bargar as disclosing this claim element. (See, Office Action: page 11). However, Bargar also fails to disclose the claim element.

As discussed above in conjunction with Claims 1 and 29, Bargar discloses determining the spline control points in a totally different manner than recited by the claimed invention. That is, Bargar discloses fitting the spline using a genetic algorithm (referred to as GA in Bargar) to compute the control points for the spline, (See, Bargar: column 5, lines 7-9; column 6, lines 1-23, 60-64), not the Applicants' recited least squares approximation. Therefore, Bargar (and the combination of Bargar and Sennott) do not disclose the claim element of fitting a polynomial spline by computing a plurality of control points yielding the *"least squares approximation"* of the data points specifying latitude and longitude coordinates.

The claim element of computing a plurality of control points yielding the *"least squares approximation"* of the data points specifying latitude and longitude coordinates that is missing in both Sennott and Bargar is not a familiar element in the prior art. Moreover, this claim element -- that is missing from the cited prior art – provides an unexpected result for the claimed invention. That is, computing the spline control points to yield a least squares approximation provides an adequate fit to model the curvature of roads for use in a geographic database for a navigation system. Both Sennott and Bargar not only fail to disclose the claim element but also

fail to predict this result of the claimed invention. Both Sennott and Bargar discuss robust and very accurate fits for the splines that would not be achieved by the least squares approximation.

Accordingly, for at least these reasons, independent Claim 16 and dependent Claims 17-22 which depend upon Claim 16 are not obvious in view of the combination of Sennott and Bargar.

B. Claims 1-3, 8-14, 16-27, 29-34 and 36-37 are not obvious in view of the combination of Sennott and Eberwine.

1. Claims 1-3, 8-13, 29-34 and 36-37 are not obvious.

Appellants' independent Claim 1 relates to a method for representing geographic features including the step of fitting a polynomial spline to the geographic feature "*by applying a least squares approximation* to the data points specifying latitude and longitude coordinates to generate a plurality of control points for the polynomial spline." Appellants' independent Claim 29 relates to a system for generating a plurality of spline control points including a processor configured to "*apply a least squares approximation* to the data points specifying latitude and longitude coordinates to generate the control points for a polynomial spline." In the Office Action, Appellants' independent Claims 1 and 29 were rejected as being obvious in view of the combination of Sennott and Eberwine.

Claims 1 and 29 are not obvious in view of the combination of Sennott and Eberwine because these references fail to disclose or suggest the claim element of *applying a least squares approximation* to data points specifying latitude and longitude coordinates to generate the control points for the polynomial spline. The Office Action stated that "Sennott et al. does not teach fitting a polynomial spline to the at least one geographic feature by applying a least squares

approximation," and the Office Action cited Eberwine as disclosing this claim element. (See, Office Action: page 18). However, Eberwine also fails to disclose the claim element.

The Eberwine patent describes a collision avoidance system that monitors an aircraft's current position and anticipated flight path. (See, Eberwine: Abstract, lines 10-12). Eberwine models the flight path as a second order polynomial $X_o + X_1t + X_2t^2$ where X_o is the position at time zero, X_1 is the velocity coefficient and X_2 is the acceleration coefficient wherein a set of these coefficients is generated for each dimension of (latitude, longitude and altitude). (See, Eberwine: column 8, lines 44-67). As pointed out in the Office Action, Eberwine discloses computing these coefficients for the disclosed second order polynomial from consecutive aircraft positions using a least squares approximation. (See, Eberwine: column 10, lines 44-67). Simply, Eberwine only discloses applying the least squares approximation to fit a second order polynomial equation not applying the least squares approximation to generate the control points for a polynomial spline.

Eberwine further discloses applying a polynomial fit to aircraft position data to generate the coefficients of the flight path equation wherein the polynomial fit may be a "cubic spline, quadratic or least squares fit." (See, Eberwine: column 14, lines 50-54). Although Eberwine mentions a cubic spline, Eberwine totally fails to discuss how to generate the control points for such a spline. The disclosed least squares is an option for the polynomial fit, whereas the cubic spline is another separate option. Eberwine recites "cubic spline, quadratic *or* least squares fit" meaning any one of these options and not a combination thereof (not fitting the spline with a least squares approximation). Thus, Eberwine does not disclose or suggest the recited least squares approximation to generate the control points for the polynomial spline.

The claim element of *applying a least squares approximation* to data points specifying latitude and longitude coordinates to generate the control points for the polynomial spline that is missing in both Sennott and Eberwine is not a familiar element in the prior art. In fact, this present appeal is the third appeal for this patent application after the Examiner reopened prosecution after the Appellants filed an appeal brief on April 18, 2008. The Examiner maintained the prior rejections and added new rejections using Eberwine as a secondary reference to show that fitting a polynomial spline is common in the art. (See, Office Action: page 33). Although fitting a spline is disclosed in the prior art, doing so with a least squares approximation is not disclosed in the prior art. None of the cited references have disclosed the claim element of *applying a least squares approximation* to data points specifying latitude and longitude coordinates to generate the control points for the polynomial spline. Moreover, this claim element -- that is missing from the cited prior art -- provides an unexpected result for the claimed invention. That is, the least squares approximation to generate the polynomial spline control points provides a useful model for the curvature of roads for use in a geographic database for a navigation system.

Sennott and Eberwine fail to disclose the claim element and fail to predict this result of the claimed invention. Sennott discusses a robust and very accurate fit for the splines. Sennott discloses using a robust method to fit the B-splines to the path for the autonomous mining vehicle to ensure continuity in curvature that will allow the vehicle to steer and readily follow the path. (See, Sennott: column 50, lines 58-66; column 52, lines 2-14). Sennott's robust fit would not be achieved by the least squares approximation. Eberwine has no disclosure regarding the method to fit the spline.

Accordingly, for at least these reasons, independent Claims 1, 29 and dependent Claims 2-3, 8-13, 30-34 and 36-37 which depend upon Claims 1 and 29 are not obvious in view of the combination of Sennott and Eberwine.

2. Claims 14 and 23-27 are not are not obvious.

Appellants' independent Claim 14 relates to a method of displaying a function representing a geographic feature where the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates. Appellants' independent Claim 23 relates to a system for displaying a function representing the geometry of a geographic feature where the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates.

In the Office Action, Appellants' independent Claims 14 and 23 were rejected as being obvious in view of the combination of Sennott and Eberwine. However, Claims 14 and 23 are not obvious in view of the combination of Sennott and Eberwine because these references fail to disclose or suggest the claim element of the spline control points are derived *"using a least squares approximation"* from data points specifying latitude and longitude coordinates. The Office Action stated that "Sennott et al. does not teach the spline control points being derived, using a least squares approximation," and the Office Action cited Eberwine as disclosing this claim element. (See, Office Action: page 25). However, Eberwine also fails to disclose the claim element.

As discussed above, Eberwine only discloses using a lease squares approximation to fit a second order polynomial equation not to derive the spline control points. Additionally, although Eberwine mentions a cubic spline, Eberwine totally fails to discuss how to compute the spline control points. The disclosed least squares is an option for the polynomial fit, and the cubic

spline is another separate option. Eberwine recites "cubic spline, quadratic *or* least squares fit" meaning any one of these options and not a combination thereof (not fitting the spline with a least squares approximation). Thus, Eberwine does not disclose or suggest the claim element of the spline control points are derived using a least squares approximation.

This claim element of spline control points are derived *"using a least squares approximation"* that is missing in both Sennott and Eberwine is not a familiar element in the prior art. Although fitting a spline is disclosed in the prior art, doing so with a least squares approximation is not disclosed in the prior art. None of the cited references have disclosed the claim element of the spline control points are derived *"using a least squares approximation"*. Moreover, this claim element -- that is missing from the cited prior art -- provides an unexpected result for the claimed invention. That is, the least squares approximation to derive the spline control points provides a useful model for the curvature of roads for use in a geographic database for a navigation system.

Accordingly, for at least these reasons, independent Claims 14, 23 and dependent Claims 24-27 which depend upon Claim 23 are not obvious in view of the combination of Sennott and Eberwine.

3. Claims 16-22 are not obvious.

Appellants' independent Claim 16 relates to a method of generating a computer-usable database including the step of fitting a polynomial spline by computing a plurality of control points yielding the *"least squares approximation"* of the data points specifying latitude and longitude coordinates. In the Office Action, Appellants' independent Claim 16 was rejected as being obvious in view of the combination of Sennott and Eberwine. However, Claim 16 is not obvious in view of the combination of Sennott and Eberwine because these references fail to

disclose or suggest the claim element of fitting a polynomial spline by computing a plurality of control points yielding the *"least squares approximation"* of the data points specifying latitude and longitude coordinates. The Office Action stated that "Sennott et al. does not teach plurality of spline control points yielding the least squares approximation," and the Office Action cited Eberwine as disclosing this claim element. (See, Office Action: page 26). However, Eberwine also fails to disclose the claim element.

As discussed above, Eberwine only discloses fitting a second order polynomial equation using a lease squares approximation not fitting a polynomial spline by computing a plurality of control points yielding the least squares approximation. Additionally, although Eberwine mentions a cubic spline, Eberwine totally fails to discuss how to compute the spline control points. The disclosed least squares is an option for the polynomial fit, and the cubic spline is another separate option. Eberwine recites "cubic spline, quadratic *or* least squares fit" meaning any one of these options and not a combination thereof (not fitting the spline with a least squares approximation). Thus, Eberwine does not disclose or suggest the claim element of fitting a polynomial spline by computing a plurality of control points yielding the least squares approximation.

This claim element of fitting a polynomial spline by computing a plurality of control points yielding the least squares approximation that is missing in both Sennott and Eberwine is not a familiar element in the prior art. Although fitting a spline is disclosed in the prior art, doing so by computing a plurality of control points yielding the least squares approximation is not disclosed in the prior art. None of the cited references have disclosed the claim element of fitting a polynomial spline by computing a plurality of control points yielding the least squares approximation. Moreover, this claim element -- that is missing from the cited prior art --

provides an unexpected result for the claimed invention. That is, fitting a polynomial spline by computing a plurality of control points yielding the least squares approximation provides a useful model for the curvature of roads for use in a geographic database for a navigation system.

Accordingly, for at least these reasons, independent Claim 16 and dependent Claims 17-22 which depend upon Claim 16 are not obvious in view of the combination of Sennott and Eberwine.

C. Claims 4, 15, 28 and 35 are not obvious over Sennott and Bargar in view of Dayanand.

Appellants' dependent Claims 4, 15, 28 and 35 are allowable at least for the reason that they depend upon allowable base claims.

D. Claims 4, 15, 28 and 35 are not obvious over Sennott and Eberwine in view of Dayanand.

Appellants' dependent Claims 4, 15, 28 and 35 are allowable at least for the reason that they depend upon allowable base claims.

E. Claims 5-7 are not obvious over Sennott and Bargar in view of Rohm.

Appellants' dependent Claims 5-7 are allowable at least for the reason that they depend upon allowable base claims.

F. Claims 5-7 are not obvious over Sennott and Eberwine in view of Rohm.

Appellants' dependent Claims 5-7 are allowable at least for the reason that they depend upon allowable base claims.

ARGUMENT SUMMARY AND CONCLUSION

Appellants have shown that the applied references fail to disclose all of the claim elements of any of the Appellants' claims. Accordingly, Appellants respectfully request the Board to reverse the rejection of Appellants' Claims 1-3, 8-14, 16-27, 29-34 and 36-37 as being obvious over Sennott in view of Bargar, reverse the rejection of Appellants' Claims 4, 15, 28 and 35 as being obvious over Sennott in view of Bargar in further view of Dayanand, and reverse the rejection of Appellants' Claims 5-7 as being obvious over Sennott in view of Bargar in further view of Rohm. Additionally, Appellants respectfully request the Board to reverse the rejection of Appellants' Claims 1-3, 8-14, 16-27, 29-34 and 36-37 as being obvious over Sennott in view of Eberwine, reverse the rejection of Appellants' Claims 4, 15, 28 and 35 as being obvious over Sennott in view of Eberwine in further view of Dayanand, and reverse the rejection of Appellants' Claims 5-7 as being obvious over Sennott in view of Eberwine in further view of Rohm.

Respectfully submitted,

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(8) CLAIMS APPENDIX

1. A method for representing geographic features in a computer-based system, comprising:

providing a first computer-usable database storing a plurality of data points specifying latitude and longitude coordinates of locations along at least one geographic feature;

fitting a polynomial spline to the at least one geographic feature by applying a least squares approximation to the data points specifying latitude and longitude coordinates to generate a plurality of control points for the polynomial spline; and

storing the control points in a second computer-usable database, the control points being usable for representing the geometry of the at least one geographic feature in the computer-based system.

2. The method of claim 1, wherein the data points are selected from the group consisting of coordinate pairs and coordinate triples.

3. The method of claim 1, further comprising:

configuring the number of control points.

4. The method of claim 1, wherein the polynomial spline is selected from the group consisting of uniform nonrational B-spline, non-uniform nonrational B-spline, uniform Catmull-Rom spline, nonuniform Catmull-Rom spline, and NURBS.

5. The method of claim 1, further comprising:

defining a knot sequence for the polynomial spline.

6. The method of claim 5, further comprising:

manually defining the knot sequence.

7. The method of claim 5, further comprising:

storing the knot sequence in the second computer-usable database.

8. The method of claim 1, further comprising:

incorporating in the least squares approximation a bearing value associated with a node included in the plurality of data points.

9. The method of claim 1, further comprising:

weighting a node included in the plurality of data points in the least squares approximation.

10. The method of claim 1, further comprising:

employing regularization in computing the least squares approximation.

11. The method of claim 1, further comprising:

identifying a straight section of the at least one geographic feature; and

storing in the second computer-usable database the data points corresponding to the straight section.

12. The method of claim 11, further comprising:

computing the control points only for one or more curved sections of the at least one geographic feature.

13. The method of claim 11, further comprising:

computing the control points such that the tangent to the spline approximation of a curved section of the at least one geographic feature and the tangent to the straight section are equal at the point at which the curved and straight section meet.

14. A method of displaying on a computer output device a function representing a geographic feature, comprising:

retrieving from a computer-usable database a plurality of spline control points associated with the geographic feature, the spline control points being derived, using a least squares approximation, from a plurality of data points specifying latitude and longitude coordinates of locations along the geographic feature;

calculating a polynomial spline using the spline control points to generate the function representing the geometry of the geographic feature; and

displaying the function on the computer output device.

15. The method of claim 14, wherein the polynomial spline is selected from the group consisting of uniform nonrational B-spline, non-uniform nonrational B-spline, uniform Catmull-Rom spline, nonuniform Catmull-Rom spline, and NURBS.

16. A method of generating a computer-usable database that represents feature geometry using a plurality of spline control points associated with a plurality of geographic features, comprising:

providing a predetermined database that represents feature geometry using a plurality of data points specifying latitude and longitude coordinates of locations along the geographic features;

for each of the geographic features, retrieving a corresponding set of data points specifying latitude and longitude coordinates from the predetermined database;

fitting a polynomial spline to each of the geographic features by computing a plurality of control points yielding the least squares approximation to the corresponding set of data points specifying latitude and longitude coordinates; and

storing the plurality of spline control points in the computer-usable database.

17. The method of claim 16, further comprising:

identifying a straight section of a geographic feature based on the data points; and

storing in the computer-usable database the data points corresponding to the straight section of the geographic feature.

18. The method of claim 17, further comprising:

computing the control points only for one or more curved sections of the geographic feature.

19. The method of claim 17, further comprising:

computing the control points for a geographic feature that has a curved section and an adjoining straight section such that a bearing value at an endpoint of the curved section equals a corresponding bearing value at an endpoint of the straight section that meets the curved section.

20. The method of claim 16, further comprising:

incorporating in the least squares approximation a bearing value associated with a node included in the plurality of data points.

21. The method of claim 16, further comprising:

weighting a node included in the plurality of data points.

22. The method of claim 16, further comprising:

employing regularization in the least squares approximation.

23. A system for displaying a function representing the geometry of a geographic feature, comprising:

a database storing one or more spline control points associated with the geographic feature, the spline control points being derived, using a least squares approximation, from a plurality of data points specifying latitude and longitude coordinates of locations along the geographic feature;

a processor configured to compute a polynomial spline using the spline control points to generate the function representing the geometry of the geographic feature; and

a display device for displaying the polyline.

24. The system of claim 23, wherein the spline control points are derived by incorporating in the least squares approximation a bearing value associated with a node included in the plurality of data points.

25. The system of claim 23, wherein the spline control points are derived using the least squares approximation by weighting a node included in the plurality of data points.

26. The system of claim 23, wherein the spline control points are derived by employing regularization in the least squares approximation.

27. The system of claim 23, wherein the processor is configured to determine whether the geographic feature includes a straight section, and if so, linearly interpolate the data points representing the straight section.

28. The system of claim 23, wherein the polynomial spline is selected from the group consisting of uniform nonrational B-spline, nonuniform nonrational B-spline, uniform Catmull-Rom spline, nonuniform Catmull-Rom spline and NURBS.

29. A system for generating a plurality of spline control points that represent feature geometry, comprising:

a first computer-usable database for storing a plurality of data points specifying latitude and longitude coordinates of locations along at least one geographic feature;

a processor configured to apply a least squares approximation to the data points specifying latitude and longitude coordinates to generate the plurality of control points for a polynomial spline; and

a second computer-usable database for storing the control points.

30. The system of claim 29, wherein the processor is configured to incorporate in the least squares approximation a bearing value associated with a node included in the plurality of data points.

31. The system of claim 29, wherein the processor is configured to weight a node included in the plurality of data points in the least squares approximation.

32. The system of claim 29, wherein the processor is configured to employ regularization in computing the least squares approximation.

33. The system of claim 29, wherein the processor is configured to determine whether the at least one geographic feature has a substantially straight section, and if so, to store in the second computer-usable database the data points corresponding to the straight section.

34. The system of claim 33, wherein the processor computes the control points only for one or more curved sections of the at least one geographic feature.

35. The system of claim 29, wherein the polynomial spline is selected from the group consisting of a uniform nonrational B-spline, nonuniform nonrational B-spline uniform Catmull-Rom spline, nonuniform Catmull-Rom spline, and NURBS.

36. The method of claim 1, wherein the geographic feature is a road.

37. The method of claim 1, wherein the data points further specifying altitude.

(9) EVIDENCE APPENDIX

There is no evidence to include with this appeal.

(10) RELATED PROCEEDINGS APPENDIX

There are no related proceedings.